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RESEARCH ARTICLE

IMPACT THE AUTOMATIC CONTROL OF CLOSED CIRCUITS DRIP IRRIGATION SYSTEM ON YELLOW CORN GROWTH AND YIELD

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Manuscript Info ***Abstract***

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The aim of this research was study the effect of automatic control of closed circuits drip irrigation system as a modified irrigation system on yellow corn crop vegetative and yield parameters under (KSA) Saudi Arabia conditions at Al-Hasa region. The field experiment carried out under automatic irrigation system for three irrigation lateral lines 40, 60, 80 m under the following three drip irrigation circuits (DIC) of: a) one manifold for lateral lines or closed circuits with one manifold of drip irrigation system (CM_1DIS); b) closed circuits with two manifolds for lateral lines (CM_2DIS), and c) traditional drip irrigation system (TDIS) as a control. Irrigation water was added in order to compensate for ETc and salt leaching requirement. Data on hand could be summarized as follow:Concerning to vegetative growth and yield parameters (leaf area (cm^2), plant height (cm), leaf length (cm), number of leaves plant^{-1}, grain and Stover yield (Kg fed^{-1}), DIC and LLL used could be ranked in the following ascending orders: TDIS < CM_2DIS < CM_1DIS and LLL_3< LLL_2< LLL_1, respectively for all studied parameters.The highest values of leaf area (cm^2), plant height (cm), leaf length (cm), number of leaves plant^{-1}; Grain and Stover yield (Kg fed^{-1}) were 498.52 cm^2, 192.52 cm, 69.32 cm, 16.63, 5.66 ton fed^{-1}; 3.81 ton fed^{-1} and the lowest ones (472.85 cm^2, 188.71 cm, 64.92 cm, 14.81, 4.53 ton fed^{-1}; 3.01 ton fed^{-1}) could be seen in the interactions: CM2DIS X LLL1 ; TDIS X LLL3, on the ranking.

Introduction

Kingdom of Saudi Arabia (KSA) has plans to use its limited water resources efficiently and overcome the gap between supply and demand. Since using modern irrigation techniques is very urgent for agricultural activities at the desert region at KSA. The application of fertilizers is usually by hand with low efficiency, resulting in higher costs and environmental problems, **(Aboukheira, 2009)**. He stated that yellow corn (*Zea Mays-L.*,) is one of the most important cereals, both for peoples and animals consumption, in Egypt and is grown for both grain and forage. The questions often arise, "What is the minimum irrigation capacity for irrigated transgenic yellow corn? And what is the suitable irrigation system for irrigating yellow corn?. These are very hard questions to answer because they greatly depend on the weather, yield goal, soil type, area conditions and the economic conditions necessary for profitability. Yellow corn (*Zea Mays-L.*) is cultivated in areas lying between 58º north latitude and 40 º south latitude from sea level up to an altitude of 3,800 metres. It is a crop which is irrigated worldwide. The main maize producing country being the USA. **(Musick*et al.*, 1990 and Filintas, 2003)**.

The irrigation water requirements of maize oscillate from 500 until 800 m^3 for achievement of maximum production by a variety of medium maturity of seed **(Doorenbos and Kassam, 1986)**. On a coarse texture soil, maize production increased with a combination of deep tillage and the incorporation of hay deposits in mulch, together with a general increase in crop irrigation **(Gill *et al.*, 1996).** Other research scientists **Filintas*et al.*, (2006, 2007)** and **Dioudis*et al.*, (2008)** have made an extensive irrigation study in the cultivation of maize, found that the same conclusion i.e. that irrigation is of the utmost importance, from the appearance of the first silk strands until the milky stage in the maturation of the kernels on the cob. Once the milky stage has occurred, the appearance of black layer development on 50 % of the maize kernels is a sign that the crop has fully ripened. The aforementioned criteria were used in the experimental plot for the total irrigation process.

Most research projects on this particular subject refer to the effect of irrigation on yellow corn yield using sprinkler irrigation or furrow irrigation. In contrast, only a few studies have been made on maize cultivation under drip irrigation **(Filintas*et al.*, 2006; Filintas*et al.*, 2007 and Dioudis*et al.*, 2008).** These few studies used the evaporation pan method to calculate the amount of water needed for irrigation. This method was used in England, in 2001, for irrigation scheduling in up to 45 % of the irrigated areas of the country in outdoor cultivation, **(Weatherhead and Danert, 2002)**. Also, an additional advantage of drip irrigation is that, there are many tools available for soil moisture measurement **Cary and Fisher, 1983; Filintas, 2005,** electronic programmers and electro hydraulic elements which give the possibility of complete automation of irrigation networks **(Charlesworth, 2000; Filintas, 2005)**.

The aim of the work presented in this paper is studying the effect of automatic control drip irrigation circuits design (DIC) used: 1- Closed irrigation circuit with one manifold for lateral lines (CM1DIS) 2- Closed irrigation circuit with two manifolds for lateral lines (CM2DIS), 3- traditional drip irrigation system (TDIS) as a control and lateral lines lengths (LLL): (LLL1 = 40m, LLL2 = 60m, LLL3 = 80m) on: Vegetative growth and yield parameters of yellow corn crop.

Material and methods

The experiment for one growing season (2012) was conducted in sandy loam soil at the Experimental Farm, Faculty of Agriculture, king Faisal University, Al-Hasa Governorate, KSA. The soil texture of the experimental site is sandy loam with water field capacity of 0.22 v/v%, wilting point 0.11% and soil bulk density of 1.44 gm/cm^3. Texture of experimental field after **(Gee and Bauder, 1986)** and Moisture retention after **(Klute, 1986).** Whereas soil chemical characteristics of soil paste saturation extract and irrigation water analysis are shown in **Tables (1, 2; 3) Rebecca, (2004).**

The field experimental design of field experiments was split in randomized complete block design with three replicates. The experimental design of laboratory experiments was split in randomized complete block design with three replicates. Laboratory tests also carried out on three irrigation lateral lines 40, 60, 80 m under the following three drip irrigation circuits (DIC) of: a) one manifold for lateral lines or closed circuits with one manifold of drip irrigation system (CM1DIS); b) closed circuits with two manifolds for lateral lines (CM2DIS), and c) traditional drip irrigation system (TDIS) as a control, **Figs. 1(a and b)** show theLayout of the controller unit and the application in the experimental field and **Fig. 1 (C)** show the drip irrigation closed circuits plots: using DIC, (CM2DIS, CM1DIS and TDIS) and treatments, (LLL1=40m;LLL2=60m and LLL3=80m). Details of the pressure and water supply control have been described by **(Safi *et al.*, 2007).** Test has been carried out in order to resolve the problem of lack of pressure head at the end of lateral lines in the TDIS. Field experiments were carried out through the growing season (2012), under the same experimental design mentioned above.

Irrigation networks include the following components are: **1.Control head:** It was located at the water source supply. It consists of centrifugal pump 3`` /3``, driven by electric engine (pump discharge of 80m^3/h and 40m lift), sand media filter 48``(two tanks), screen filter 2`` (120 mesh), back flow prevention device, pressure regulator, pressure gauges, flow-meter, control valves and chemical injection, **2. Main line:** PVC pipes of 75mm in (ID) Ø to convey the water from the source to the main control points in the field, **3. Sub-main lines:** PVC pipes of 75mm in (ID) Ø were connected to with the main line through a control unit consists of a 2`` ball valve and pressure gauges, **4. Manifold lines:** PVC pipes of 50mm in (ID) Ø were connected to the sub main line through control valves 1.5``, **5. Lateral lines:** PE tubes of 16 mm in (ID) Ø were connected to the manifolds through beginnings stalled on manifolds lines, **6. Emitters**: These emitters (GR) built in PE tubes 16mm in (ID) Ø, emitter discharge of 4 lh^{-1} at 1 atm. nominal operating pressure and30 cm spacing in-between. The components of closed circuits of the drip system include, supply lines, control valves, supply and return manifolds, drip lateral lines, emitters, check valves and air relief valves/vacuum breakers.

The flow rate through the pipe put depends on pipe surface roughness and air layer resistance. The change of hydraulic friction coefficient values, depending on variations in *Re* number values. Hydraulic losses at plastic pipes might be calculated as losses at hydraulically smooth pipes, multiplied by correction coefficients that assess losses at pipe joints and air resistance.

Irrigation scheduling: Intervals of irrigation (I) in day were calculated using the following equations:

I = d / ETc …………………………….…….………………… **(1)**

Where: d = net water depth applied per each irrigation (mm), and *ETc* = crop evapotranspiration (mm/day).

d = AMD . ASW . Rd . P ……………………………….. **(2)**

Where: AMD = allowable soil moisture depletion (%), ASW = available soil water, (mm water/m depth), Rd = effective root zone depth (m), or irrigation depth (m), and p = percentage of soil area wetted (%).

$AW_{(v/v\ \%)} = ASW_{(w/w\ \%)}$. B.D …………………….……..…… **(3)**

Where: B.D. = Soil bulk density (gm cm^{-3}).

Irrigation Intervals used was 4 days under both closed circuits and traditional drip irrigation systems.

Measuring the Seasonal evapotranspiration (*ETc*):

The (*ETc*) was computed using the Class Pan evaporation method for estimating (*ETo*) on daily basis was taken from nearest meteorological station as showing in **Table (4)**.

The modified pan evaporation equation to be used:

ETo= KpEp……………………………………...…….. **(4)**

where: *ETo* = reference evapotranspiration [mm day^{-1}],

Kp= pan coefficient of 0.76 for Class A pan placed in short green cropped and medium wind area. *Ep*= daily pan evaporation (mm day^{-1}), Seasonal average is [7.5 mm day^{-1}].**(Allen *et al.*, 1998).**

The reference evapotranspiration (***ETo***) is then multiplied by a crop coefficient Kc at particular growth stage to determine crop consumptive use at that particular stage of maize growth.

ETc= EToKc…………..………………..……..……………. **(5)**

The reduction factor (Kr) was calculated using **Eq. 6**.

Kr = GC + ½ (1 - GC)……………….…………………….. **(6)**

Where: GC = ground cover percentage.

Irrigation efficiency (Ea) calculated by

Ea =Ks Eu ……………………………………….…... (7)

Where: Ea = Irrigation efficiency, Eu = emission uniformity (%) and Ks = reduction factor of soil wetted.

Table (1): Soil physical properties of the experimental site

Soil ample Depth (cm)	Particle size distribution (%)				Texture class	*FC (v/v %)	*WP	*AW	BD (g/cm^3)	HC (cm/h)
	C. sand	F.sand	Silt	Clay						
0-15	3.7	54.5	25.2	16.6	**SL**	0.22	0.11	0.11	1.45	1.11
15-30	3.8	55.8	24.6	15.8	**SL**	0.22	0.11	0.11	1.43	1.28
30-45	4.6	53.7	26.0	15.7	**SL**	0.22	0.11	0.11	1.43	1.28
45-60	4.6	55.9	25.5	14.0	**SL**	0.21	0.10	0.11	1.42	1.53

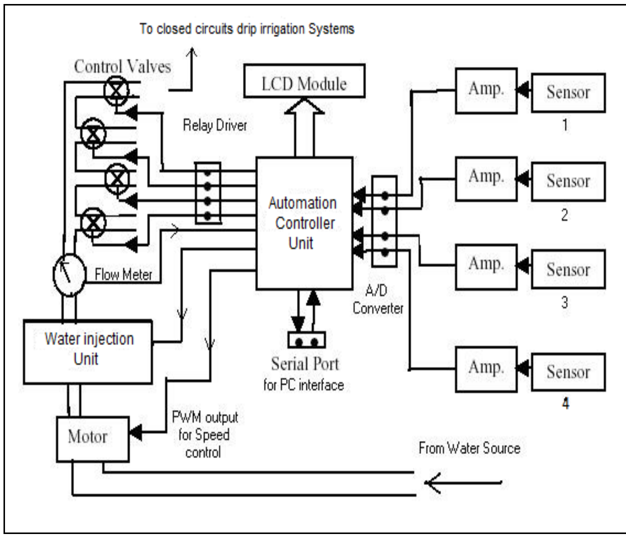
(*) Determined as percentage in (V/V %) cm^3 Water/ cm^3 Soil, (SL): Sandy loam, Soil; HC: Hydraulic conductivity; and BD: Bulk density.

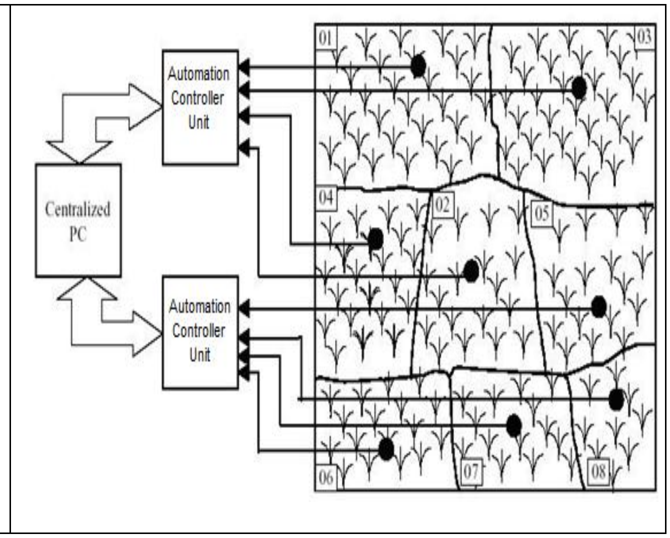
Table (2): Chemical analysis of the soil

Soil sample depths (cm)	Cations (Meq/l)				Anions (Meq/l)				pH	E.C (dS/m)
	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}		
0-15	6.43	4.89	185.0	18.84	0	5.64	6.65	58.7	8.10	1.97
15-30	11.53	6.49	237.1	25.01	0	5.21	10.53	62.6	8.13	2.98
30-45	12.15	7.97	279.1	26.63	0	3.68	11.48	64.0	8.11	3.61
45-60	12.56	4.17	307.1	32.28	0	3.62	5.6	66.9	8.03	3.76

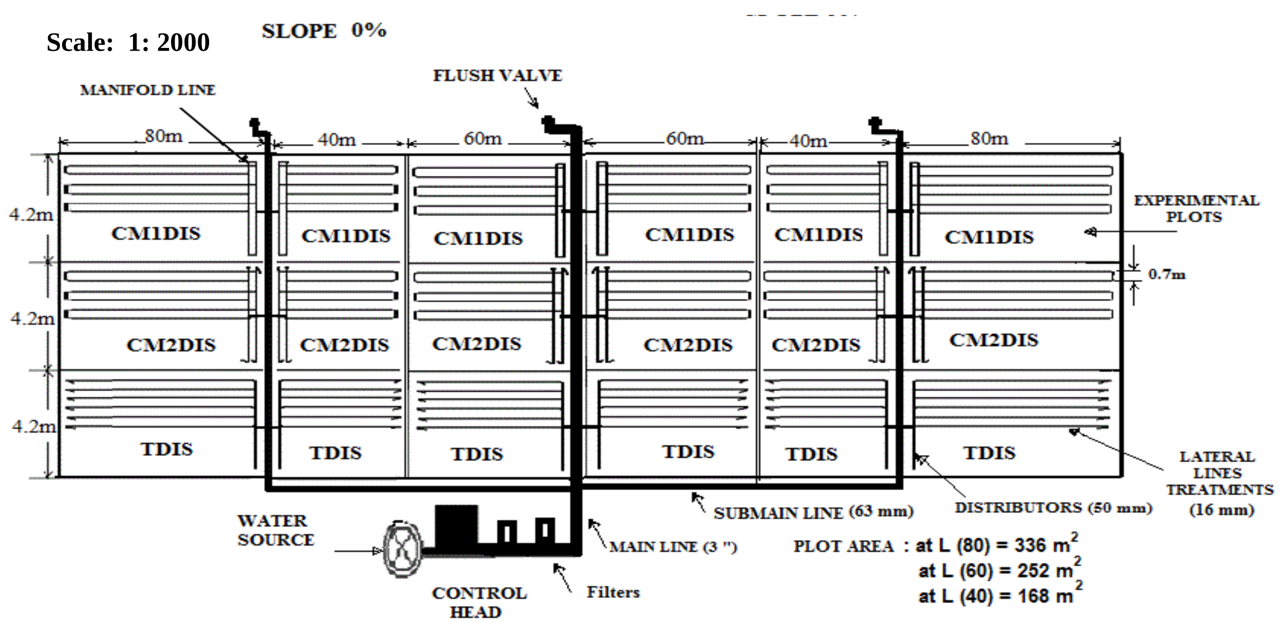
Table (3): Chemical analysis of irrigation water

Cations(Meq/l)				Anions(Meq/l)				pH	E.C (dS/m)
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$Co_3^{=}$	Hco_3^{-}	Cl^{-}	$So_4^{=}$		
0.7	1.72	128	13	0.0	3.4	1.8	67	7.48	2.0





(a): Control unit **(b): Application to field**



(C): Layout of closed circuits drip irrigation system plots.

Fig. (1) Automatic control unit, application to experimental field and using closed circuits of drip irrigation system (CM2DIS, CM1DIS and TDIS); under treatments of (LLL_1=40m;LLL_2=60m and LLL_3=80m).

Yellow corn (*Zea mays-L.,* Ghota-82, Varity) was cultivated in Al-Hasa, KSA, farm of Agriculture Faculty, King faysal University on April, 2, 2012. The distance between rows was 0.7 m and 0.25 m between plants in the row. Each row was irrigated by a single straight lateral line in the closed circuits and traditional drip irrigation plots. **Fig. (1)** Shown that the total experimental area was 4536 m^2.Under each of the tested drip irrigation circuits, plot areas of Lateral lines lengths were 168, 252 and 336 m^2 under LLL1=40 m, LLL2=60m and LLL3=80m, respectively. Irrigation season of transgenic yellow corn was ended 11 days before harvest. Transgenic yellow corn was harvested on September 15. Plants densities were 42000 plants per fed according to (ISU), Northeast Research and Demonstration Farm. Fertilization program had been done according to the recommended doses throughout the growing season (2011) for drought yellow corn crop under the investigated irrigation systems using fertigation technique. These amounts of fertilizers NPK (20-20-10), were 74. 6 kg/fed of (20 % N) and 33.0 kg/fed of (20 % K2O). While 60.5 kg/fed of (10 % P2O5).

For all plots, weed and pest control applications followed recommendations of transgenic yellow corn yield in Al-Hasa, KSA.

Measurements of yellow corn plant growth and yield:

Components of yield or measured include plant height (cm), leaf length (cm), leaf area (cm^2), number of leaves $plant^{-1}$, total grain weight Kg/fed and Stover yield (Kg/fed). Plant measurements and observations were started 21 days after planting, and were terminated on the harvest date. All plant samples were dried at 65^o C until constant weight was achieved. Grain yield was determined by hand harvesting the 8m sections of three adjacent center rows in each plot on 2012 and was adjusted to 15.5% water content. In all treatments plots, the grain yields of individual rows were determined in order to evaluate the yield uniformity among the rows.

MSTATC program (Michigan State University) was used to carry out statistical analysis. Treatments mean were compared using the technique of analysis of variance (ANOVA) and the least significant difference (L.S.D) between systems at 1 %.**(Steel and Torrie, 1980).**

Table (4): Water requirements for transgenic yellow corn grown at the experimental site.

Month	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Epan (mm/day)	6.58	6.34	7.85	9.43	9.23	7.28
Kp	---------- 0.71 ----------					
Kc	1.05	1.08	1.15	1.17	1.22	1.25
Kr	0.45	0.90	0.95	1.00	1.00	1.00
ETo (mm/day)	4.66	4.52	5.57	6.70	6.59	5.13
ETc (mm/day)	2.20	4.39	6.08	7.84	8.04	6.41
Ks	---------- 100% (1.00) ----------					
Eu	---------- 90% (1.11) ----------					
Lr	---------- 10% ----------					
Growth stage	Planting(Establishment)	Vegetative	Flowering		Ribbing yield Harvesting	
Length of growth stage	2-21 Ap.	21 Ap-1 Jun	2 Jun-5 Jul		6 Jul-5 Aug.	
Number of Days (Irri. season)	19	42	34		31	
IRg (mm/month)	51.5	227.2	209.7	57.9	257.5	88.0
IRn (mm/month)	41.8	184.4	170.2	47.0	209.0	64.1

Results and Discussion

Table (5) and Figs. (2:4) showed the main one of drip irrigation circuits (DIC) and sub-main one of the lateral line length (LLL) on some vegetative growth and yield parameters of yellow corn. Measured parameters were: leaf area (cm^2), plant height (cm), leaf length (cm), number of leaves, grain yield (ton/fed) and stover yield (ton/fed).

Leaf area (LA) (cm^2):

Table (5) and Fig. (2a) illustrated the effect of different DIC and LLL on LA. Data could be ranked in the following descending order: CM2DIS > CM1DIS > TDIS. Concerning the LA, results attained indicated significant differences among means values of both main effect DIC and sub-main effect LLL. According to the effect of interaction between both investigated factors, the highest and lowest values of LA were recorded at CM2DIS and LLL1. Also, data noticed that under all DIC, all highest values were observed at LLL1.

Plant height (ph)(cm):

Data in **Table (5)** and plotted in **Fig. (2b)** indicated that the same trend of LA plant height (ph) took. The effect of DIC and LLL could be ranked in the following descending orders: CM2DIS > CM1DIS > TDIS and LLL1 > LLL2 > LLL3, respectively. Differences in ph were significant at 1 % level among all means values of LLL. Also, differences within values of DIC treatment were significant at the 1% level except that between CM2DIS and CM1DIS. The effect of interaction between two studied factors were significant at the 1 % level except in the following interactions: CM2DIS X LLL3, CM1DIS X LLL2, CM1DIS X LLL3 and TDIS X LLL3. The maximum and minimum values of ph were found in the interactions of LLL1 X CM2DIS and LLL3 X TDIS, respectively.

Leaf length (LL):

Data of **Table (5) and Fig. (3a)** illustrated the effect of different DIC and LLL on LL (cm). According to LL, DIC and LLL could be ranked in the following descending orders: CM1DIS > CM2DIS > TDIS and LLL1 ≥ LLL2 > LLL3, respectively.

Table (5) Effect of irrigation circuits designs and lateral lines lengthson yellow corn plants growth and yield.

ICD	L.L.L. (m)	Growth and Yield Characteristics at Harvest(average)					
		Leaf area (cm^2)	Plant height (cm)	Leaf length (cm)	No. of leaves per plant	Yield (ton/fed)	
						Grain	Stover
CM2DIS	40	498.52a	192.52a	69.32a	16.63a	5.66a	3.81a
	60	495.37c	191.91b	67.25d	15.35dc	5.43c	3.54d
	80	491.13e	190.35e	66.43f	15.13f	5.23f	3.32gf
CM1DIS	40	497.27b	191.34c	68.75b	15.52b	5.47b	3.72b
	60	489.67f	190.28f	66.38e	15.13gf	5.28e	3.45e
	80	476.42h	189.67h	65.17h	14.95h	5.07g	3.19h
TDIS	40	495.23d	190.97d	68.12c	15.36c	5.37d	3.61c
	60	487.78g	189.85g	65.18g	15.23e	4.76h	3.32f
	80	472.85i	188.71i	64.92i	14.81i	4.53i	3.01i
(1) X (2)	LSD 0.01	0.86	0.07	0.11	0.06	0.02	0.01
(1) Means	CM2DIS	495.01a	191.59a	67.66a	15.70a	5.26a	3.56a
	CM1DIS	487.78b	190.43b	66.76b	15.20ba	5.27ba	3.45b
	TDIS	485.29c	189.84c	66.07c	15.13cba	4.88c	3.31c
	LSD 0.01	2.33	0.09	0.06	0.84	0.04	0.01
(2) Means	40	497.01a	191.61a	68.73a	15.84a	5.50a	3.71a
	60	490.94b	190.68b	66.27b	15.24ba	5.16b	3.44b
	80	480.13c	189.58c	65.51c	14.96cab	4.94c	3.17c
	LSD 0.01	1.92	0.14	1.17	1.81	0.02	0.01

ICD: Irrigation circuit design, L.L.L.: Lateral line length, CM_2DIS: Closed circuits with tow manifolds separately, CM_1DIS: Closed circuits with one manifold, TDIS: Traditional drip irrigation system.

Concerning to the LL, data indicated that there is significant difference within main effect (DIC), while the highest and the lowest values were recorded at CM1DIS and TDIS, respectively. Whereas there is significant difference within LLL treatments except between LLL1 and LLL2 at the 1 % level. The highest value was recorded at LLL1 and the lowest one was recorded at LLL3 treatment. The effect of interaction among the two study factors, data indicated that there were significant differences between treatments at the 1 % level. The maximum and minimum values of LL were recorded at CM2DIS; LLL1 and TDIS; LLL3.

Number of leaves per plant (LN plant^{-1}):

Table (5) and Fig. (3b) indicated the effect of DIC and LLL on LN per plant, it could be ranked in following descending order: CM2DIS > CM1DIS > TDIS. Differences in LN per plant between means of the two factors studied were significant at the 1 % level. While the highest and lowest values under DIC and LLL were achieved at CM2DIS; TDIS and LLL1; LLL3, respectively. The maximum and minimum values of LN plant-1 were (significantly at 1%) recorded at CM2DIS X LLL3 and TDIS X LLL1, respectively. The superiority of the studied growth parameters under (CM2DIS; CM1DIS relative to TDIS) and (LLL1; LLL2 relative to LLL3) can be noticed this superiority was due to improving both water and fertilizers distribution uniformity.

Grain yield (GY):

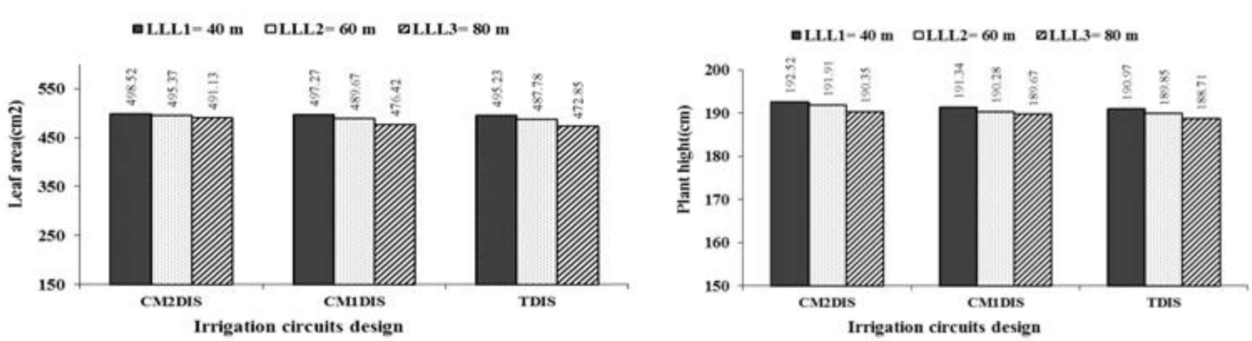
Data in **Table (6)andFig. (4a)** indicate the effect of DIC and LLL on yellow corn GY (ton/fed), both of them could be ranked in the following ascending orders: TDIS < CM1DIS < CM2DIS and LLL3< LLL2< LLL1, respectively. In respect to the main effect of (DIC) on GY, one can notice that, the differences in GY were significant among all DIC at the 1 % level. The highest and lowest GY were obtained in CM2DIS and TDIS, respectively. According to GY, the effect of LLL on GY, there is significant differences at the 1 % level between LLL1, LLL2; LLL3, whenever highest and lowest values were achieved under LLL1 and LLL3, respectively. Concerning the effect of DIC X LLL on GY, there were significant differences at the 1 % level, except at the following interactions: CM2DIS X LLL3, TDIS X LLL1, CM2DIS X LLL3 and CM1DIS X LLL2. The maximum and minimum values of GY were obtained in CM2DIS X LLL1 and TDIS X LLL3, respectively.

We can notice that yellow corn GY took the same trend of other vegetative growth parameters, and this finding could be attributed to the close correlation between vegetative growth from side and grain yield from the other one.

Stover yield (SY):

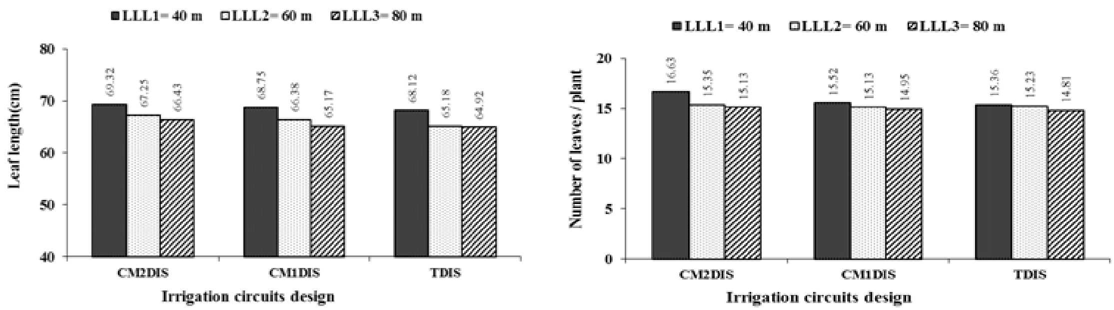
Table (6) and Fig. (4b) indicated the effect of both (DIC) and (LLL) on SY (ton/fed). We can notice that the change in SY took the same trend of vegetative growth parameters and thus took the trend of GY also due to previous reasons mentioned before.

Concerning the positive effect of (DIC and LLL) on SY, they could be ranked in following descending orders: CM2DIS > CM1DIS > TDIS and LLL1 > LLL2 > LLL3. In respect to (DIC and LLL) effect on the SY, one can notice significant difference at the 1 % level between all means values of DIC and LLL. According to the interaction effect of the investigated factors, the highest value of SY



(a) (b)

Fig. (2) Effect of different irrigation circuits designs and lateral line lengths on leaf area and plant height of yellow corn plants.



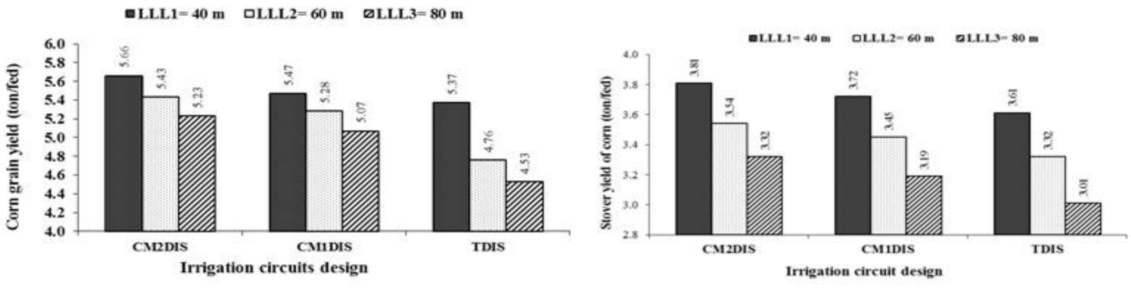
(a) **(b)**

Fig.(3) Effect of different irrigation circuits designs and lateral line lengths on leaf length and number of leaves per plant.

Table (6) Effect of irrigation circuits designs and lateral lines lengths on Grain and Stover yield.

ICD	L.L.L. (m)	Yield (ton/fed)	
		Grain	**Stover**
CM2DIS	**40**	5.66a	3.81a
	60	5.43c	3.54d
	80	5.23f	3.32gf
CM1DIS	**40**	5.47b	3.72b
	60	5.28e	3.45e
	80	5.07g	3.19h
TDIS	**40**	5.37d	3.61c
	60	4.76h	3.32f
	80	4.53i	3.01i
(1) X (2)	**LSD 0.01**	**0.02**	**0.01**
(1) Means	**CM2DIS**	5.26a	3.56a
	CM1DIS	5.27ba	3.45b
	TDIS	4.88c	3.31c
	LSD 0.01	**0.04**	**0.01**
(2) Means	**40**	5.50a	3.71a
	60	5.16b	3.44b
	80	4.94c	3.17c
	LSD 0.01	**0.02**	**0.01**

ICD: Irrigation circuit design, L.L.L.: Lateral line length, CM_2DIS: Closed circuits with tow manifolds separately, CM_1DIS: Closed circuits with one manifold, TDIS: Traditional drip irrigation system.



(a) **(b)**

Fig.(4) Effect of different irrigation circuits designs and lateral line lengths yellow corn grain and Stover yield.

Conclusion

Automatic control of drip irrigation systems, as cutting edge technology in irrigation methods has many advantages but it is associated with some problems and obstacles i.e. low water pressure at the end of lateral lines and salt accumulation. Closed-circuits were proposed as incorporating modification to the traditional drip irrigation system. The aims of the work were to study the effect of drip irrigation circuits (DIC) used: 1- Closed irrigation circuit with one manifold for lateral lines (CM_1DIS), 2- Closed irrigation circuit with two manifolds for lateral lines (CM_2DIS), 3- traditional drip irrigation system (TDIS) as a control and lateral lines lengths (LLL): (LLL_1 = 40m, LLL_2 = 60m, LLL_3 = 80m) on: Vegetative growth and yield parameters of yellow corn crop.

To achieve aims mentioned above. The field experiment was conducted at Al-Hasa Experimental Farm, Faculty ofAgriculture, King Faisal University, KSA. Vegetative growth and yield parameters of yellow corn crop. Vegetative growth i.e.: leaf area (LA), Leaf length (LL), leaf number plant-1 (LN), Plant height (ph), grain yield (GY), and Stover yield (SY). To carry out items mentioned above a field experiment for one growing season (2012) was conducted in sandy loam soil at the experimental farm. After seed bed preparation yellow corn grains (*ZeaMays-L*), Varity (Ghota-82) were seeded on April, 2, 2012 (42000 plant fed^{-1}). Plants were irrigated every 4 days using DIC. Irrigation water was added in order to compensate for ETc and salt leaching requirement. Data on hand could be summarized as follow:

1-Concerning to vegetative growth and yield parameters (leaf area (cm^2), plant height (cm), leaf length (cm), number of leaves $plant^{-1}$, grain and Stover yield (Kg fed^{-1}), DIC and LLL used could be ranked in the following ascending orders: TDIS < CM1DIS < CM2DIS and LLL3 < LLL2 < LLL1, respectively for all studied parameters.

2-The effect of interaction DIC X LLL on vegetative growth and yield parameters mentioned above was significant at the 1% level with few exceptions. The highest values of leaf area (cm^2), plant height (cm), leaf length (cm), number of leaves $plant^{-1}$; grain and Stover yield (Kg fed^{-1}) were 498.52 cm^2, 192.52 cm, 69.32 cm, 16.63, 5.66 ton fed^{-1}; 3.81 ton fed^{-1} and the lowest ones (472.85 cm^2, 188.71 cm, 64.92 cm, 14.81, 4.53 ton fed^{-1}; 3.01 ton fed^{-1}) could be seen in the interactions: CM2DIS X LLL1 ; TDIS X LLL3, respectively.

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